

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

Amendments to the Claims

This listing will replace all prior versions and listings of claims in the application:

Listing of Claims

1. (currently amended) A method of separating water from air comprising the steps of:
 - (a) contacting air having water vapour with an hygroscopic liquid mixture to produce a water rich hygroscopic liquid mixture;
 - (b) heating at least a portion of the water rich hygroscopic liquid mixture to produce a gaseous mixture including water vapour and at least one other gaseous component;
 - (c) condensing at least a portion of the water vapour in the gaseous mixture to produce liquid water and a depleted gaseous mixture at a first pressure; and

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

(d) removing at least a portion of the at least one other gaseous component to maintain the first pressure below a predetermined ~~pressure~~. pressure;

wherein the depleted gaseous mixture is in fluid communication with the water rich hygroscopic liquid mixture being heated.

2. (original) The method as claimed in claim 1, wherein the predetermined pressure is subatmospheric.
3. (original) The method as claimed in claim 1, wherein the predetermined pressure is between 25 Torr and 760 Torr.
4. (original) The method as claimed in claim 2, wherein at least a portion of the water vapour is absorbed by the hygroscopic liquid mixture during the contacting in step (a).
5. (original) The method as claimed in claim 4, wherein the method further comprises the step of separating the liquid water from the depleted gaseous mixture such that the depleted gaseous mixture is disposed in a vapour space above the liquid water.

U.S. Application Serial No.: 10/768,390

Amendment dated December 26, 2006

In response to Office Action Dated July 24, 2006

6. (original) The method as claimed in claim 5, wherein the removing in step (d) occurs in response to a high concentration indication of one of the at least one other gaseous component.
7. (original) The method as claimed in claim 5, wherein the removing in step (d) occurs in response to a high pressure indication in the vapour space.
8. (original) The method as claimed in claim 5, wherein the removing in step (d) occurs in response to a low temperature indication in the vapour space.
9. (original) The method as claimed in claim 5, wherein the removing of at least a portion of the at least one other gaseous component is effected by a vacuum pump.
10. (original) The method as claimed in claim 9, wherein the hygroscopic liquid mixture is an aqueous lithium chloride solution.
11. (original) A method of separating water from air comprising the steps of:

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

(a) contacting air having water vapour with an hygroscopic liquid mixture to produce a water rich hygroscopic liquid mixture;

(b) heating at least a portion of the water rich hygroscopic liquid mixture to produce a gaseous mixture having water vapour;

(c) condensing at least a portion of the water vapour in the gaseous mixture to produce liquid water and heat energy; and

(d) transferring an effective amount of the heat energy to a working fluid including a liquid to effect vapourization of at least a portion of the liquid to produce a working fluid gaseous mixture;

wherein the condensing is effected at least in part by the transferring in step (d); and

wherein the working fluid is contained in a heat pipe.

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

12-13. (canceled)

14. (currently amended) The method as claimed in ~~claim 13,~~
claim 11, wherein the hygroscopic liquid mixture is an
aqueous lithium chloride solution.

15. (original) The method as claimed in claim 14, wherein the
condensing is effected at a subatmospheric pressure.

16. (original) A method of recovering water from air comprising
the steps of:

(a) contacting air having water vapour with an hygroscopic
liquid mixture to produce a water rich hygroscopic liquid
mixture;

(b) in a first pressure envelope, heating the water rich
hygroscopic liquid mixture to produce a gaseous mixture
having water vapour, condensing at least a portion of the
water vapour in the gaseous mixture to produce liquid water
and a depleted gaseous mixture, and separating the liquid
water from the depleted gaseous mixture so as to provide
collected liquid water and a depleted gaseous mixture at

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

subatmospheric pressure disposed in a vapour space above the collected liquid water;

(c) effecting fluid pressure communication between a second pressure envelope and the vapour space; and

(d) flowing the collected liquid from the first pressure envelope and into the second pressure envelope.

17. (original) The method as claimed in claim 16, wherein the flowing step (d) is effected by draining the collected liquid water by gravity.
18. (original) The method as claimed in claim 17, wherein the second pressure envelope is a tank.
19. (original) The method as claimed in claim 18, wherein the hygroscopic liquid mixture is an aqueous lithium chloride solution.
20. (original) The method as claimed in claim 19, wherein a vacuum pump is fluidly coupled to the vapour space to effect removal of at least a portion of the depleted gaseous mixture to maintain pressure within the vapour

U.S. Application Serial No.: 10/768,390

Amendment dated December 26, 2006

In response to Office Action Dated July 24, 2006

space at a subatmospheric pressure, and wherein the vacuum pump is also configured to effect evacuation of the tank.

21. (withdrawn) An absorption system for effecting removal of water from atmospheric air by an hygroscopic liquid mixture comprising:

an absorber vessel defining a space for facilitating contact between air having water vapour and an hygroscopic liquid mixture, including:

an input air flow inlet, configured for introducing an input air flow having water vapour into the space;

a depleted air flow outlet, configured for discharging a depleted air flow; and

means for introducing a hygroscopic liquid mixture into the space for effecting contact between the hygroscopic liquid mixture and the input air flow;

a base;

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

wherein the absorber vessel is rotatably mounted to the base about an axis for effecting positioning of the input air flow inlet at a desired position relative to the axis.

22. (currently amended) A method of recovering water from air comprising:

(a) providing an absorption system for effecting removal of water from atmospheric air flow by an hygroscopic liquid mixture comprising:

an absorber vessel defining a space for facilitating contact between air having water vapour and an hygroscopic liquid mixture, including an input air flow inlet, configured for introducing an input air flow having water vapour into the space, a depleted air flow outlet, configured for discharging a depleted air flow, and means for introducing a hygroscopic liquid mixture into the space for effecting contact between the hygroscopic liquid mixture and the input air flow; and

a base;

U.S. Application Serial No.: 10/768,390

Amendment dated December 26, 2006

In response to Office Action Dated July 24, 2006

wherein the absorber~~-vessel~~ vessel is rotatably mounted to the base about an axis for effecting positioning of the input air flow inlet at a desired position relative to the axis;

(b) measuring the direction of atmospheric air flow; and

(c) rotating the absorber vessel about the axis so as to effect desired positioning of the input air flow inlet relative to the atmospheric air flow direction in response to the measured atmospheric air flow direction.

23. (withdrawn) An absorber vessel defining a space for facilitating contact between air having water vapour and an hygroscopic liquid mixture, including:

an input air flow inlet, configured for introducing an input air flow having water vapour into the space;

a depleted air flow outlet, configured for discharging a depleted air flow;

at least one first liquid inlet spray nozzle, configured for introducing a largest diameter fine size droplet into the space at a first position;

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

a second liquid inlet spray nozzle, configured for introducing a largest diameter coarse size droplet into the space at a second position disposed in closer proximity to the outlet relative to the introduced largest diameter fine size droplet;

wherein the largest diameter coarse size droplet has a greater diameter than the largest diameter fine size droplet when the same liquid is flowed through each of the first and second liquid inlet spray nozzles under the same operating conditions.

24. (withdrawn) The apparatus as claimed in claim 23, wherein the largest diameter coarse size droplet has a diameter which is 100 times greater than a diameter of the largest diameter fine size droplet when the same liquid is flowed through each of the first and second liquid inlet spray nozzles under the same operating conditions.
25. (withdrawn) The apparatus as claimed in claim 23, wherein the largest diameter coarse size droplet has a diameter which is 1,000 times greater than a diameter of the largest diameter fine size droplet when the same liquid is flowed

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

through each of the first and second liquid inlet spray nozzles under the same operating conditions.

26. (withdrawn) The apparatus as claimed in claim 23, wherein the largest diameter coarse size droplet has a diameter which is 100,000 times greater than a diameter of the largest diameter fine size droplet when the same liquid is flowed through each of the first and second liquid inlet spray nozzles under the same operating conditions.
27. (original) A method of separating water from air comprising the steps of:
- providing an absorber vessel defining a space for facilitating contact between air having water vapour and an hygroscopic liquid mixture;
- introducing an air flow into the space;
- spraying first hygroscopic liquid mixture droplets into the space for effecting contact between the first hygroscopic liquid mixture and the air flow, wherein at least one of the first hygroscopic liquid mixture droplets is a largest diameter fine size droplet; and

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

spraying second hygroscopic liquid mixture droplets into the space downstream of the first hygroscopic liquid mixture droplets for effecting contact between the second hygroscopic liquid mixture and the air flow containing an entrained portion of the first hydroscopic liquid mixture droplets, wherein at least one of the second hygroscopic liquid mixture droplets is a largest diameter coarse size droplet;

wherein the largest diameter coarse size droplet has a greater diameter than the largest diameter fine size droplet.

28. (original) The method as claimed in claim 27, wherein the largest diameter coarse size droplet has a diameter which is 100 times greater than the diameter of the largest diameter fine size droplet.
29. (original) The method as claimed in claim 27, wherein the largest diameter coarse size droplet has a diameter which is 1000 times greater than the diameter of the largest diameter fine size droplet.

U.S. Application Serial No.: 10/768,390

Amendment dated December 26, 2006

In response to Office Action Dated July 24, 2006

30. (original) The method as claimed in claim 27, wherein the largest diameter coarse size droplet has a diameter which is 100,000 times greater than the diameter of the largest diameter fine size droplet.
31. (original) A method of separating water from air comprising the steps of:
- (a) contacting air having water vapour with a hygroscopic liquid mixture consisting of a supersaturated aqueous solution of lithium chloride to produce a water rich hygroscopic liquid mixture;
 - (b) heating at least a portion of the water rich hygroscopic liquid mixture to produce a gaseous mixture including water vapour and at least one other gaseous component;
 - (c) condensing at least a portion of the water vapour in the gaseous mixture to produce liquid water.
32. (canceled)
- 33. (new) A method of separating water from air comprising the steps of:

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

- (a) contacting air having water vapour with an hygroscopic liquid mixture to produce a water rich hygroscopic liquid mixture;
 - (b) heating at least a portion of the water rich hygroscopic liquid mixture to produce a gaseous mixture including water vapour and at least one other gaseous component;
 - (c) condensing at least a portion of the water vapour in the gaseous mixture to produce liquid water and a depleted gaseous mixture at a first pressure; and
 - (d) removing at least a portion of the at least one other gaseous component to maintain the first pressure below a predetermined pressure; and
 - (e) separating the liquid water from the depleted gaseous mixture such that the depleted gaseous mixture is disposed in a vapour space above the liquid water;
- wherein the depleted gaseous mixture is in fluid communication with the water rich hygroscopic liquid mixture being heated;
- wherein the predetermined pressure is subatmospheric;
- wherein at least a portion of the water vapour is absorbed by the hygroscopic liquid mixture during the contacting in step (a); and

U.S. Application Serial No.: 10/768,390

Amendment dated December 26, 2006

In response to Office Action Dated July 24, 2006

wherein the removing in step (d) occurs in response to a high concentration indication of one of the at least one other gaseous component.

34. (new) A method of separating water from air comprising the steps of:

(a) contacting air having water vapour with an hygroscopic liquid mixture to produce a water rich hygroscopic liquid mixture;

(b) heating at least a portion of the water rich hygroscopic liquid mixture to produce a gaseous mixture including water vapour and at least one other gaseous component;

(c) condensing at least a portion of the water vapour in the gaseous mixture to produce liquid water and a depleted gaseous mixture at a first pressure;

(d) removing at least a portion of the at least one other gaseous component to maintain the first pressure below a predetermined pressure; and

(e) separating the liquid water from the depleted gaseous mixture such that the depleted gaseous mixture is disposed in a vapour space above the liquid water;

wherein the depleted gaseous mixture is in fluid communication with the water rich hygroscopic liquid mixture being heated;

U.S. Application Serial No.: 10/768,390

Amendment dated December 26, 2006

In response to Office Action Dated July 24, 2006

wherein the predetermined pressure is subatmospheric;
wherein at least a portion of the water vapour is absorbed
by the hygroscopic liquid mixture during the contacting in
step (a); and
wherein the removing in step (d) occurs in response to a
high pressure indication in the vapour space.

35. (new) A method of separating water from air comprising the steps of:
- (a) contacting air having water vapour with an hygroscopic liquid mixture to produce a water rich hygroscopic liquid mixture;
 - (b) heating at least a portion of the water rich hygroscopic liquid mixture to produce a gaseous mixture including water vapour and at least one other gaseous component;
 - (c) condensing at least a portion of the water vapour in the gaseous mixture to produce liquid water and a depleted gaseous mixture at a first pressure;
 - (d) removing at least a portion of the at least one other gaseous component to maintain the first pressure below a predetermined pressure; and
 - (e) separating the liquid water from the depleted gaseous mixture such that the depleted gaseous mixture is disposed in a vapour space above the liquid water;

U.S. Application Serial No.: 10/768,390

Amendment dated December 26, 2006

In response to Office Action Dated July 24, 2006

wherein the depleted gaseous mixture is in fluid communication with the water rich hygroscopic liquid mixture being heated;
wherein the predetermined pressure is subatmospheric;
wherein at least a portion of the water vapour is absorbed by the hygroscopic liquid mixture during the contacting in step (a); and
wherein the removing in step (d) occurs in response to a low temperature indication in the vapour space.

36. (new) A method of recovering water from air comprising the steps of:
- (a) contacting air having water vapour with an hygroscopic liquid mixture to produce a water rich hygroscopic liquid mixture;
 - (b) in a first pressure envelope, heating the water rich hygroscopic liquid mixture to produce a gaseous mixture having water vapour, condensing at least a portion of the water vapour in the gaseous mixture to produce liquid water and a depleted gaseous mixture, and separating the liquid water from the depleted gaseous mixture so as to provide collected liquid water and a depleted gaseous mixture at subatmospheric pressure disposed in a vapour space above the collected liquid water;

U.S. Application Serial No.: 10/768,390
Amendment dated December 26, 2006
In response to Office Action Dated July 24, 2006

(c) effecting fluid pressure communication between a second pressure envelope and the vapour space; and
(d) flowing the collected liquid from the first pressure envelope and into the second pressure envelope;
wherein the flowing step (d) is effected by draining the collected liquid water by gravity;
wherein the second pressure envelope is a tank;
wherein the hygroscopic liquid mixture is an aqueous lithium chloride solution; and
wherein a vacuum pump is fluidly coupled to the vapour space to effect removal of at least a portion of the depleted gaseous mixture to maintain pressure within the vapour space at a subatmospheric pressure, and wherein the vacuum pump is also configured to effect evacuation of the tank.